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Coeloma rupeliense (Crustacea, Decapoda, Brachyura) from the Bilzen Formation (Rupel Group, Lower Oligocene) in northeast Belgium

by John W.M. JAGT, Barry W.M. VAN BAKEL & René H.B. FRAAIJE

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Abstract

A sediment-compacted and decorticated carapace, preserving the left cheliped and a portion of the left eye stalk, from the so-called '*Nucula* Klei' of previous authors (= Kleine Spouwen Member, Bilzen Formation, Rupel Group), of Early Oligocene age, constitutes the first record of *Coeloma rupeliense* STAINIER, 1887 from temporary sections along the Albertkanaal between Kesselt and Veldwezelt (Limburg, northeast Belgium). *Coeloma rupeliense* is commonly preserved in concretions from the correlative Boom Formation in the provinces of Oost-Vlaanderen and Antwerpen, north of the rivers Rupel and Nete (northwest Belgium), and has also been recorded from the Lower Oligocene of northern Germany, both *in situ* and from erratic boulders. Some notes on the genus *Coeloma* A. MILNE-EDWARDS, 1865, and on species assigned to it, are added.

Keywords: Crustacea, Decapoda, Brachyura, *Coeloma*, Oligocene, Belgium.

Résumé

Une carapace compactée et décortiquée, avec le chélipède gauche et une partie du pédoncule oculaire gauche préservés, provenant de la '*Nucula* Klei' des anciens auteurs (= Kleine Spouwen Member, Bilzen Formation, Rupel Group), d'âge Oligocène inférieur, représente le premier témoignage de la présence de *Coeloma rupeliense* STAINIER, 1887 dans des coupes temporaires le long du Canal Albert, entre Kesselt et Veldwezelt (Limbourg, nord-est de la Belgique). *Coeloma rupeliense* est communément préservé dans des concrétions du même âge de la Formation de Boom, dans les provinces de Flandre-Orientale et d'Anvers, au nord des rivières Rupel et Nete (nord-ouest de la Belgique), et a aussi été détecté dans l'Oligocène inférieur du nord de l'Allemagne, aussi bien *in situ* que dans des blocs erratiques. Quelques commentaires sur le genre *Coeloma* A. MILNE-EDWARDS, 1865 et sur les espèces assignées sont ajoutés.

Mots-clefs: Crustacea, Decapoda, Brachyura, *Coeloma*, Oligocène, Belgique.

Introduction

In the Belgian provinces of Oost-Vlaanderen and Antwerpen, in particular north of the rivers Rupel and Nete (Fig. 1), strata of Early Oligocene (Rupelian) age have yielded numerous decapod crustaceans ever since clay extraction for brick production started around 1850. These faunas, which generally are preserved in concretions and nodules, comprise mostly rare paguroids and dromiaceans, plus common lobsters and goneplacoid crabs (VERHEYDEN, 2002; VAN BAKEL *et al.*, 2003, 2006, 2009). Records of crabs from correlative strata in the province of Limburg (northeast Belgium; Fig. 1) are comparatively rare. The discovery in a temporary outcrop along the Albertkanaal of a moderately preserved specimen of *Coeloma rupeliense* from the so-called '*Nucula* Klei', a greenish brown to yellowish grey, sandy clay with numerous specimens of the nuculid bivalve *Nucula* (*Lamellinucula*) *comta* GOLDFUSS, 1837, came as some surprise. The '*Nucula* Klei' is an informal name for the Kleine Spouwen Member of the Bilzen Formation (CLAES *et al.*, 2001; LAGA *et al.*, 2002; VANDENBERGHE *et al.*, 2004). Although only a single specimen from Belgian Limburg is available to date, the presence of *C. rupeliense* does confirm that the Bilzen Formation is the lateral equivalent of the Boom Formation (see VANDENBERGHE *et al.*, 2002), to which the species is confined in northwest Belgium.

There is a consensus amongst decapod crustacean workers (see e.g., DE GRAVE *et al.*, 2009; SCHWEITZER *et al.*, 2010) that the genus *Coeloma*, its 'subgenera' *Paracoeloma* BEURLEN *in* LÖRENTHEY & BEURLEN, 1929, *Intercoeloma* POLKOWSKY, 2005 and *Litoricola*

WOODWARD, 1873, as well as species assigned to all of these, are in urgent need of revision. With broadly overlapping geographic and stratigraphic ranges, and only subtle differences in dorsal carapace morphology to distinguish the various forms, it would appear that too much splitting has occurred in this group.

Material and methods

The single specimen available to date, MAB k. 2866 (Pl. 1) in the collections of the Oertijdmuseum De Groene Poort (Boxtel, the Netherlands), originates from temporary outcrops on the western bank of the Albertkanaal between Kesselt and Veldwezelt (Fig. 1) in the early 1990s, at a time when the canal was broadened between the villages of Kanne in the south and of Gellik in the north (see also BAUT & GÉNAULT, 1999). It was discovered by breaking up chunks of clay, replete with shells of nuculid bivalves. The carapace has suffered compaction, is almost wholly decorticated, with few remains of cuticle left, and lacks important features such as anterolateral spines, although it does preserve the rostrum, basal portions of orbital spines, the left cheliped as well as a portion of the left eye stalk. Unfortunately, the exact provenance level within the Kleine Spouwen Member sequence of the present specimen is unknown, because neither the top nor the base of the unit were visible at the time of collection. CLAES *et al.* (2001, p. 24) indicated an average thickness between 6 and 7 metres (and a maximum of 10 m) for this unit in the area covered by sheet 34 (Tongeren) of the topographical map of Belgium.

Systematic palaeontology

For now, we follow DE GRAVE *et al.* (2009) and SCHWEITZER *et al.* (2010) in assigning the genus *Coeloma* to the family Mathildellidae KARASAWA & KATO, 2003, rather than to Geryonidae COLOSI, 1924. However, we consider a revision of the genus, its 'subgenera' and all species long overdue. The recent addition of a new 'subgenus' and a new species has blurred the picture even further (see ILYIN, 2005; POLKOWSKY, 2005).

Genus *Coeloma* A. MILNE-EDWARDS, 1865

Type species: *Coeloma vigil* A. MILNE-EDWARDS, 1865, by monotypy.

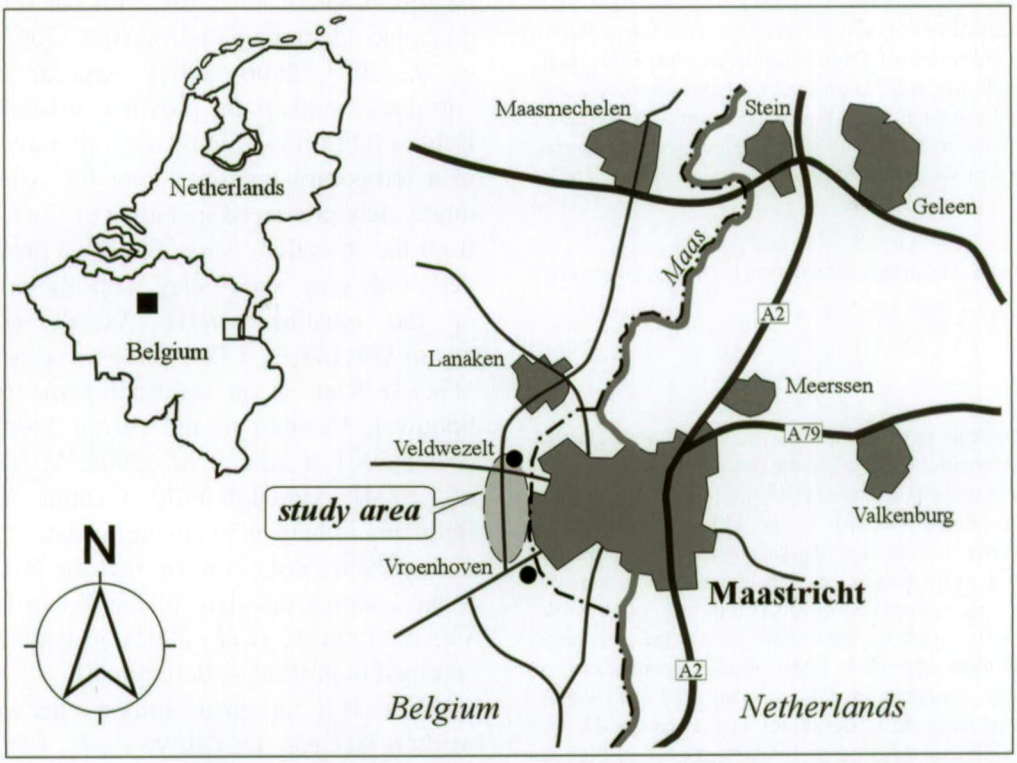

Fig. 1 – Map of Belgium and the Netherlands, with indication of the Waasland-Boom area (provinces of Oost-Vlaanderen and Antwerpen; solid symbol) and of the Albertkanaal sections between Kesselt and Veltwezelt (province of Limburg; open symbol).

Coeloma rupeliense STAINIER, 1887
Pl. 1

1887 – *Coeloma rupeliense* STAINIER, p. 86, pl. 5, figs. 1-5.
2002 – *Coeloma* (*Paracoeloma*) *rupeliense* STAINIER, 1887 – VERHEYDEN, p. 172, pl. 1, figs. 1, 2; pl. 2, figs. 1, 2; pl. 4, fig. 1; text-figs. 2-5 (with additional synonymy).

Material
A single specimen, MAB k. 2866.

Description
Carapace more or less trapezoidal in shape, wider than long (as preserved, length *c.* 40 mm, width *c.* 48 mm); L/W ratio *c.* 0.83; maximum carapace width one third of maximum carapace length from the front; width of orbitofrontal area equalling 45 per cent of carapace width; front broad, bilobed; orbits very wide and concave, bounded by inner and outer orbital spines (basal portions of which are preserved); anterolateral margin oblique, short; protuberances/spines not preserved; regions well delineated; epigastric lobes small, rounded; protogastric lobes larger, bordered posteriorly by clear cervical groove; anterior mesogastric process narrow, mesogastric lobe more or less merged posteriorly with urogastric lobe; elevations on mesogastric lobe faint; cardiac lobe flat, with two faint elevations; hepatic regions poorly preserved; epibranchial regions small, with slight elevation leading towards spine (not preserved); postbranchial region flat, with two protuberances, the anterior one elongate, the posterior one larger and more or less circular; posterolateral margin straight, oblique; transition into posterior margin more or less angular; posterior margin with clear rim; carapace surface covered with more or less uniformly sized pustules; left cheliped poorly preserved, consisting of flat and comparatively wide merus, carpus and propodus; portion of eye stalk preserved, fairly wide, yet delicate.

Discussion
In spite of the mediocre state of preservation, MAB k. 2866 is best assigned to *C. rupeliense*, on the basis of carapace shape and division, in particular the presence of two protuberances on the postbranchial region (see below), which compare well with specimens illustrated by VERHEYDEN (2002, pl. 1). *Coeloma rupeliense* is a well-known species (see STAINIER, 1887, p. 86, pl. 5, figs. 1-5), with which *Portunus nodosus* VAN BENEDEN, 1883 (p. 132) and *Coeloma holsaticum* STOLLEY, 1890 (p. 151, pl. 5, fig. 1a-d; pl. 6, fig. 1a-e) have subsequently been synonymised (see STAINIER & BERNAYS, 1899).

VAN STRAELEN (1921, pp. 123-125 [15-17]) listed *Coeloma rupeliense* for the 'Étage Rupélien', i.e., the Boom Clay Formation in modern terminology, at Burght [= Burcht] and Kontich, close to Antwerpen. VERHEYDEN (2002, p. 179) recorded this species from what he referred to as the Lower Oligocene (Latdorfian) of Germany, the middle Oligocene (Rupelian) of Belgium (Antwerpen area) and of Niedersachsen, Schleswig-Holstein and Mecklenburg-Vorpommern in Germany (see also GRAMANN & MUTTERLOSE, 1975; MOTHS & MONTAG, 2002).

Remarks on the genus Coeloma *and its relationships*
At present, *Coeloma* comprises almost twenty 'species'. There is a consensus amongst authors that morphologically all are very close and can only be distinguished on details of their dorsal carapaces and, possibly, chelipeds. This observation, coupled with the broadly overlapping stratigraphic and geographic ranges of some of these forms (Table 1), strongly suggests that too much splitting has occurred within this group. A reassessment of the type material of all taxa and of the diagnoses of the various 'subgenera' appears long overdue. Such is beyond the scope of the present note, but we do wish to add some comments below.

Coeloma rupeliense is the type species, by original designation, of the subgenus *Paracoeloma* BEURLEN *in* LÖRENTHEY & BEURLEN, 1929 (p. 243). These authors (pp. 241-243) favoured a subdivision of the genus *Coeloma* into three groups, as follows (translated from German):

1. forms with a short, curved orbital margin and a clear areolation of the branchial regions, to which were assigned *C. martinezensis* RATHBUN, 1926 [Lower Eocene, California, USA], *C. glabrum* (WOODWARD, 1873) [Lower Eocene, England], *C. dentatum* (WOODWARD, 1873) [ditto] and *C. vareolatum* LÖRENTHEY, 1898 [Middle Eocene, southern Germany]. For this primitive, rather divergent group, which is restricted to the Lower and Middle Eocene, the name *Litoricola* is available (type species: *L. glabra*);
2. forms with a comparable orbital margin, but with strong areolation of branchial regions, to which were assigned *C. egerense* BEURLEN *in* LÖRENTHEY & BEURLEN, 1929 [Lower Oligocene, Hungary], *C. rupeliense*, *C. holsaticum* and *C. bicarinatum* RAVN, 1904 [Lower Oligocene, East Greenland; compare LARSEN *et al.*, 2002]. In many ways, this is reminiscent of *Litoricola* but in carapace areolation it shows a parallel development to *C.* (*Coeloma*).

Table 1 – Selected species of *Coeloma* considered in the present paper, arranged alphabetically; * = original reference. Note: *Coeloma* (?) *helmstedtense* BACHMAYER & MUNDLOS, 1968 from the lower Oligocene of northern Germany (see also LIENAU, 1984) has recently been transferred to the geryonid *Chaceon* by SCHWEITZER *et al.* (2010, p. 106), an action which we consider justified. For a complete list of all taxa assigned to *C.* (*Coeloma*) or *Coeloma* [*sensu lato*], reference is made to SCHWEITZER *et al.* (2010, p. 137).

Species	**Geographic and stratigraphic distribution, plus pertinent references**
C. balticum	northern Germany, the Netherlands; mid-Eocene to Lower Oligocene SCHLÜTER (1879)*; NOETLING (1885); POSTHUMUS (1923); DE NEVE (1945); BACHMAYER & MUNDLOS (1968); GRAMANN & MUTTERLOSE (1975); SPAINK (1978); LIENAU (1984), FREESS (1992); FRAAIJE (2003), POLKOWSKY (2005), FRAAIJE *et al.* (2007)
C. bicarinatum	Greenland; Lower Oligocene RAVN (1904); LARSEN *et al.* (2002)
C. birsteini	Mangyshlak (Kazakhstan); Oligocene ILYIN (2005)*
C. credneri	Germany; Upper Oligocene NOETLING (1881)*, GRAMANN & MUTTERLOSE (1975), POLKOWSKY (2005)
C. incarinatum	Denmark; Upper Oligocene-Lower Miocene SORGENFREI (1940)*, MOTHS & MONTAG (2002)
C. latifrons	northern Germany; Lower Oligocene FÖRSTER & MUNDLOS (1982)*, LIENAU (1984)
C. taunicum	central Germany; Middle Oligocene VON MEYER (1862)*, FREESS (1992)
C. vigil	northern Italy, Hungary, Slovakia, Crimea (Ukraine); Upper Eocene to ?Middle Oligocene A. MILNE-EDWARDS (1965)*, ALLASINAZ (1987), DE ANGELI & BESCHIN (2001), ILYIN (2005), HYŽNÝ (2007)

The range is Lower to Middle Oligocene, or even upper Oligocene;

3. forms with a long, straight orbital margin and clearly expressed areolation of branchial regions, to which were assigned: *C. granulatum* A. MILNE-EDWARDS, 1881 [Upper Eocene, southwest France], *C. vigil* A. MILNE-EDWARDS, 1865 [Lower Oligocene, northern Italy], *C. balticum* SCHLÜTER, 1879 [Middle Eocene-Lower Oligocene, Germany, the Netherlands), *C. reidemeisteri* NOETLING, 1885 [Lower Oligocene, northern Germany] and *C. taunicum* VON MEYER, 1862 [Middle Oligocene, central Germany]. This is *C.* (*Coeloma*); the stratigraphic range is Upper Eocene to Middle Oligocene.

BEURLEN (*in* LŐRENTHEY & BEURLEN, 1929, p. 243) also remarked that *C. credneri* NOETLING, 1881, the sole well-documented Late Oligocene form, differed very much from other groups in details of anterolateral margin and carapace areolation, occupying a different position, for which maybe a new subgenus or genus would have to be erected.

POLKOWSKY (2005, pp. 48-49) introduced the subgenus *Intercoeloma*, for *C. taunicum*, to comprise forms which were intermediate in morphology between species of *C.* (*Coeloma*) and *C.* (*Paracoeloma*), but from his overview (pp. 53-55) of 'diagnostic' features of the various subgenera, it appears that there is quite some overlap and that distinctions are not at all clear cut. Although BEURLEN (*in* LŐRENTHEY & BEURLEN, 1929), in the original description of the subgenus *Paracoeloma*, did not specifically refer to well-developed protuberances on the branchial regions, most recent authors, inclusive of POLKOWSKY (2005, p. 53) have accepted the presence of such as a diagnostic character. The fact that the present specimen (Pl. 1) reveals such protuberances would favour alliance with this group. More research is needed to determine whether or not the subdivision into *Paracoeloma* and *Intercoeloma* is warranted; at present, we consider these subgenera to fall under the heading *Coeloma sensu lato*.

Based on the markedly flat carapace, with arched anterolateral and very long posterolateral margins and pronounced sexual dimorphism in chelipeds (male major cheliped much enlarged; see ARTAL & VÍA, 1989, pl. 1), it appears warranted to treat *Litoricola* as a distinct genus. Its taxonomic placement should be verified using well-preserved ventral characters which are available in diverse species referred to this genus. A suite of crabs, referred to as *Litoricola* by WOODWARD (1873) and preserved in the collections of the Sedgwick

Museum (University of Cambridge, England), confirms that *Xanthilites macrodactylus pyrenaicus* ARTAL & VÍA, 1989 does indeed belong to that genus (P. ARTAL, pers. comm., May 2010).

A final observation we wish to make is the fact that the short, near-vertical anterolateral margin and very wide orbits are features which *Coeloma* has in common with *Proterocarcinus* FELDMANN, CASADÍO, CHIRINO-GÁLVEZ & AGUIRRE-URRETA, 1995, which currently is assigned to the Macropipidae STEPHENSON & CAMPBELL, 1960. To date, this genus comprises four species from lower Paleogene to Neogene strata in Argentina and southern Chile (GLAESSNER, 1933; FELDMANN *et al.*, 1995, 2005, 2010; CASADÍO *et al.*, 2004). The two characters noted above distinguish both *Proterocarcinus* and *Coeloma* from the geryonids *Chaceon* MANNING & HOLTHUIS, 1989 and *Geryon* KRØYER, 1837.

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John W.M. JAGT
Natuurhistorisch Museum Maastricht
De Bosquetplein 6-7
NL-6211 KJ Maastricht, The Netherlands
E-mail: john.jagt@maastricht.nl

Barry W.M. VAN BAKEL
Oertijdmuseum De Groene Poort
Bosscheweg 80
NL-5283 WB Boxtel, The Netherlands
and
Nederlands Centrum voor Biodiversiteit (Naturalis)
Postbus 9517
NL-2300 RA Leiden, the Netherlands
E-mail: barryvanbakel@gmail.com

René H.B. FRAAIJE
Oertijdmuseum De Groene Poort
Bosscheweg 80
NL-5283 WB Boxtel, The Netherlands
E-mail: info@oertijdmuseum.nl

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Explanation of the plate

PLATE 1

Coeloma rupeliense STAINIER, 1887 (MAB k. 2866), dorsal view of carapace and left cheliped, from the Kleine Spouwen Member (Bilzen Formation, Rupel Group; lower Oligocene, Rupelian) between Vroenhoven and Veldwezelt (temporary Albertkanaal sections, early 1990s), province of Limburg, northeast Belgium; coated with ammonium chloride prior to photography.